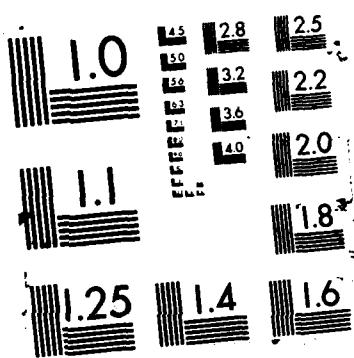


AD-A185 689 CONTINUOUS VIGILANCE SIMULATOR WITH REAL-TIME 1/1
UNCLASSIFIED NEUROENDOCRINE CORRELATION(U) HARVARD MEDICAL SCHOOL
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18 SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
Physiological Monitoring,
Electroencephalography

19 ABSTRACT (Continue on reverse if necessary and identify by block number)
A Continuous Electroencephalographic and Physiologic Monitoring System was configured using a VAX 11/750 control unit. The system combines three important and interrelated functions: monitoring the health and safety of human research subjects during long-term studies; scheduling and recording discrete events such as meal times, bedtimes, and performance test times; and collecting physiologic data from the subject.

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The Continuous Electroencephalographic and Physiologic Monitoring System is a automated data acquisition system currently in use in the Neuroendocrinology Lab of the Brigham and Women's Hospital. It was completed in June of 1985, funded by Air Force Office of Scientific Research Grant no. AFOSR830309. The system combines three important and interrelated functions: monitoring the health and safety of human research subjects during long-term studies; scheduling and recording discrete events such as meal times, bedtimes, and performance test times; and collecting physiologic data from the subject. The latter function is the most demanding of the three, due to the nature of the research and the requirement that multiple channels of physiologic data be recorded in real time, automatically, continuously for up to several months, with great reliability, and in the case of certain electrophysiologic data, at high speeds.

To meet these demands, the system uses a Digital VAX 11/750 control unit. The VAX is optimally configured for this application, with two 456-megabyte fixed disk drives to permit storage and access of the large files created by high-speed data channels during long recordings. A floating point accelerator allows rapid statistical analysis of these same files on the same system. A laboratory peripheral accelerator preprocessor subsystem (DEC LPA11) handles the high-speed data acquisition channels through DMA interface with the main system, relieving the control unit of the highest frequency realtime tasks. The system has the capability to digitize eight different channels of electroencephalographic data on each of two different subjects at

two hundred samples per second per channel for eight to ten hours at a time, maintain the data on disk for computer analysis, display it visually on a CRT display scope, and transfer it onto tape for archival storage, while simultaneously carrying out all its other data acquisition, event control, and performance testing functions.

The principal data acquisition devices connected to the system are the ten-channel electronic linearizing thermometer and the two eight-channel electroencephalograph machines. The electrically-isolated thermometer records body temperature, which is the most important and reliable indicator of the status of a subject's circadian timing system. The EEG machines record brain waves, muscle tonus, eye movements, and cardiac pulse signals. These signals, during sleep, indicate the depth and quality of sleep, and during wakefulness they indicate the occurrence of unwanted sleep episodes or entry into states of consciousness other than full alert wakefulness. Both types of data are essential in interpreting the results of any human performance study, particularly one that designs to take into account the subject's sleep-wake cycle and its possible disruption by schedule changes, transmeridian travel, medications, changes in illuminance level, or environmental isolation.

The system is installed in the Environmental Scheduling Facility (ESF) of the Neuroendocrinology Lab. This facility consists of three separate study suites, each capable of housing a human subject, for periods of time ranging from hours to months, in a controlled environment. The suites are completely



Availability Code:	
Date	Actual and Specified
A-1	

sealed from outdoor light, are soundproofed to exclude noise, and are air conditioned independently from the surrounding building. Thus, subjects can be isolated from all environmental time cues when necessary. In addition, two of the suites contain wall-mounted banks of lights, each incorporating sixty eight-foot full-spectrum fluorescent lamps in an area of 112 square feet, capable of simulating the illuminance of outdoor sunlight. The three suites adjoin a common Control Room, where most of the instrumentation is located.

Integration of the Continuous Electroencephalographic and Physiologic Monitoring System with the ESF has created a powerful research tool for the study of the effects of schedule changes, environmental conditions, illuminance level, and other synchronizers of the human circadian timing system on human performance. Results already obtained in research using this facility represent significant breakthroughs in the understanding of human circadian physiology. One achievement of particular importance is the characterization of the human phase resetting curve to bright light, and the concomitant discovery of methods by which the human circadian clock may be rapidly and accurately reset for optimum performance in any time zone.

ITEM	VENDOR	MANUFACTURER	PURPOSE	TOTAL COST
		SYSTEM CONTROLLER		
VAX Computer system including:	Digital Equipment Corp. 235 Wyman St Waltham, MA 02154	Digital Equipment Corp. Waltham, Massachusetts	Real-time data acquisition, performance tasking, real-time event control, data file management, statistical data analysis, and graphic display generation	110,774.99
- VAX-11/750 CPU				
- 2 MB Main Memory				
- RU400 Disk Controller				
- Two RAB1 436 MB Fixed Disk Drives				
- Two D211 Asynchronous 8-line Multiplexers				
- TUBO Magnetic Tape Subsystems				
- FP750 Floating Point Processor				
- LA120 Console Terminal				
- LP411 Microprocessor Subsystems for high speed data acquisition and A/D conversion				
- Necessary cabinets, backplanes, and interconnect cables				
- VMS Operating System				
- FORTRAN Programming Language				
- Field Service during installation period (1 year)				
Four ERGO 325 Video Graphics Terminals	Source Associates 304 Compton Avenue Laurel, MD 20777	Micro-Term Inc. Fenton, Missouri	General-purpose terminals for programming, process control, data entry, and interactive data analysis	6,354.00
			SYSTEM COMPONENTS FOR PHYSIOLOGICAL AND ELECTROPHYSIOLOGICAL DATA ACQUISITION	
Two EEG 520B eight-channel Electroencephalograph machines	Nihon Kohden (America) Inc. 1632 Deere Avenue Irvine, CA 92714	Nihon Kohden (America) Inc. Irvine, California	Recording of electroencephalographic and other electrophysiological data relating to sleep, alertness and state of consciousness	18,690.56
PT1101 Ten-channel Electronic Thermometer with Power Supply and two 4 1/2 digit displays	Alpine Instruments 34 Lodge Road Newton, MA 02165	Alpine Instruments Newton, Massachusetts	Recording of body temperatures (an important correlate of circadian physiological status) and environmental conditions	3,258.00

Initial Software Development Brigham/Beth Israel
for real-time DA and Medical Group
event scheduling 20 Kent Street
Brattleboro, MA 02146

Software developed in-house for
specialized data acquisition
and process control applications

20,976.00

SYSTEM COMPONENTS FOR ANALYSIS, TRANSFER, AND DISPLAY OF DATA

P300 Line Printer with
Controller, Cable, and
Field Service during
Installation period
(1 year)

SBS Electronics
150 Industrial Ave. East
Lowell, MA 01852

High-speed text output
and hardcopy graphic output

7,274.00

630MP1 Letter Printer w/
Frama Tractor and
Acoustic Cover
Half-inch tape drive with
DEC Q-Bus compatible
Interface

David Jamison Carlyle Inc.
5700 Buckingham Pkwy.
Culver City, CA 90230

High quality hardcopy output
for report generation

3,373.53

Digi-Data Inc.
(Cabinet - Ziero Inc.)

Tape drive compatible with
other Harvard Medical School
computer systems to facilitate
interlaboratory data transfer

7,514.75

Autalink 212A Modem
Source Associates
304 Compton Avenue
Laurel, MD 20707

U.S. Robotics Inc.
Chicago, Illinois

Remote data transfer

475.00

VIDEO SURVEILLANCE SUBSYSTEM

Two JTCABAG Low-Light
Video Cameras
With:
Two EMI Video Camera Lenses

L. Matthew Miller
Associates
48 West 21st Street
New York, NY 10010

3,070.79

Two PTZ700GP Pan/Tilt
Units with Wall Mounts
Two TC1112 12-Inch Black
and White Video Monitors

Chugai International
Plainview, New York
PELCO Inc.
Gardena, California
RCA Corporation
Lancaster, Pennsylvania

3,070.79

ELECTROPHYSIOLOGIC DATA REAL-TIME DISPLAY SUBSYSTEM

HP 1347A Graphics Display Generator	Hewlett Packard 1775 Minuteman Rd. Andover, MA 01810	Hewlett Packard Andover, Massachusetts	Viewing and analysis of digitized electrophysiological data	7,280.00
HP 1310B 19-inch X-Y Display Monitor	Hewlett Packard (see above)	Hewlett Packard Andover, Massachusetts	Displays output of the 1347A (above)	5,100.00
IEEE-488 (HP11B) Interface	Digital Equipment Corp 235 Wyman St. Waltham, MA 02154	Digital Equipment Corp Waltham, Massachusetts	Allows the 1347A to be controlled by the VAX unit	1,072.00

EVENT CONTROL SUBSYSTEM

Si-Terminex HT/30 Hand-Held Control Units	Terminex Corporation 316 Daniel Webster Highway Merrimack, NH 03054	Terminex Corporation Merrimack, New Hampshire	Serve as keypads for single-key marking and logging of events as they occur in real time	1,990.00
DZ11-C 8-line Asynchronous Multiplexer	Digital Equipment Corp 235 Wyman St. Waltham, MA 02154	Digital Equipment Corp Waltham, Massachusetts	Allows the system controller to communicate with the event marker keypads	2,712.00
Two VT240 Video Displays Terminals	Harvard University Office for Informational Technology 1730 Cambridge St. Cambridge, MA 02138	Digital Equipment Corp Waltham, Massachusetts	Displays upcoming scheduled events and subject status information for the on-duty technician.	3,497.00

TOTAL ----- 211,005.22

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